• Today I have been given this opportunity to provide an update on the State of the Lake Huron fish community.

• Agency staff working on Lake Huron presented the health of the lake biotic community up to 1999 at a GLFC sponsored symposium held in March of 2001 in Sault Ste. Marie, ON.

• Today I will be giving an update of the most important findings of that symposium.

• As a short background...

•Lake Huron was the first of the Great Lakes discovered by European explorers.

• The Lake Huron ecosystem has undergone many changes since that time.

Fisheries collapsed by the 1950s from sea lamprey predation and over fishing

Alewife invaded and their population exploded

• Among the most significant changes to the lake ecosystem were the invasion of rainbow smelt in the 1920's, and Alewife and sea lamprey in the1930s.

• Sea lamprey predation and overfishing led to the collapse of lake trout by the 1950's (although two remnant stocks barely survived).

•With no predators to control alewife populations, their numbers exploded and nuisance die-offs were common.

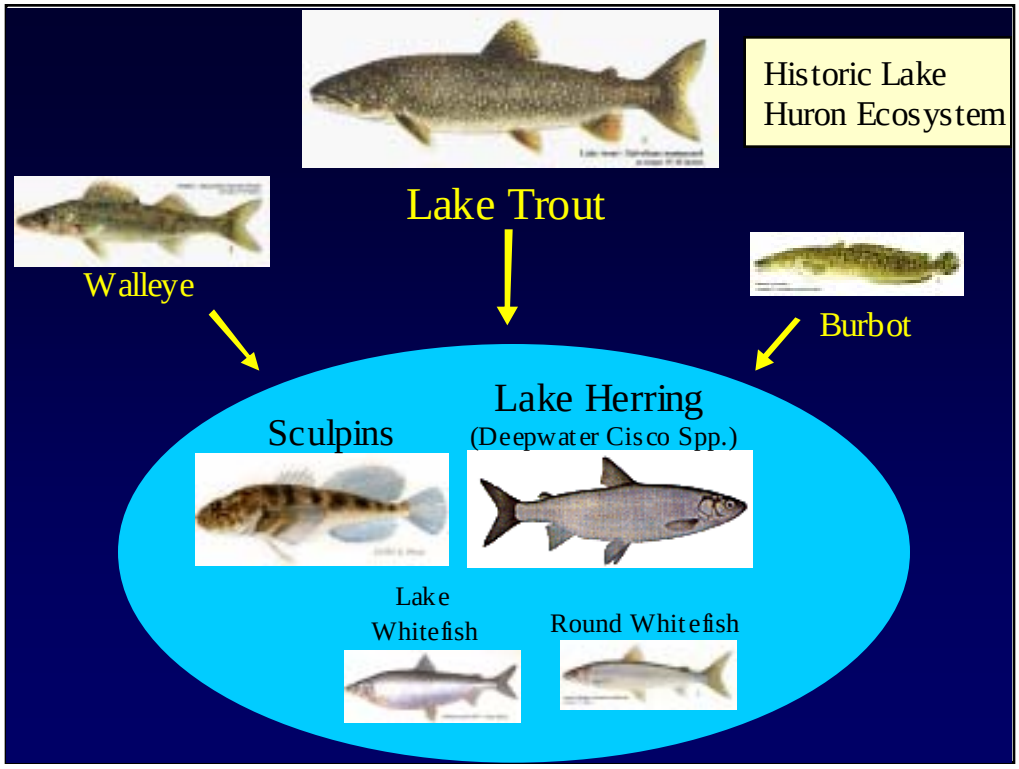
• Beaches were littered for miles with dead alewife during the 1960s

• Fishing and tourism were severely impacted

• The turnaround came with sea lamprey control in the 1960s which allowed stocking and survival of Pacific salmon, lake trout and other predators.

• Restocking controlled both smelt and alewife, prevent nuisance alewife die-offs and resulted in exceptionally good fishing.

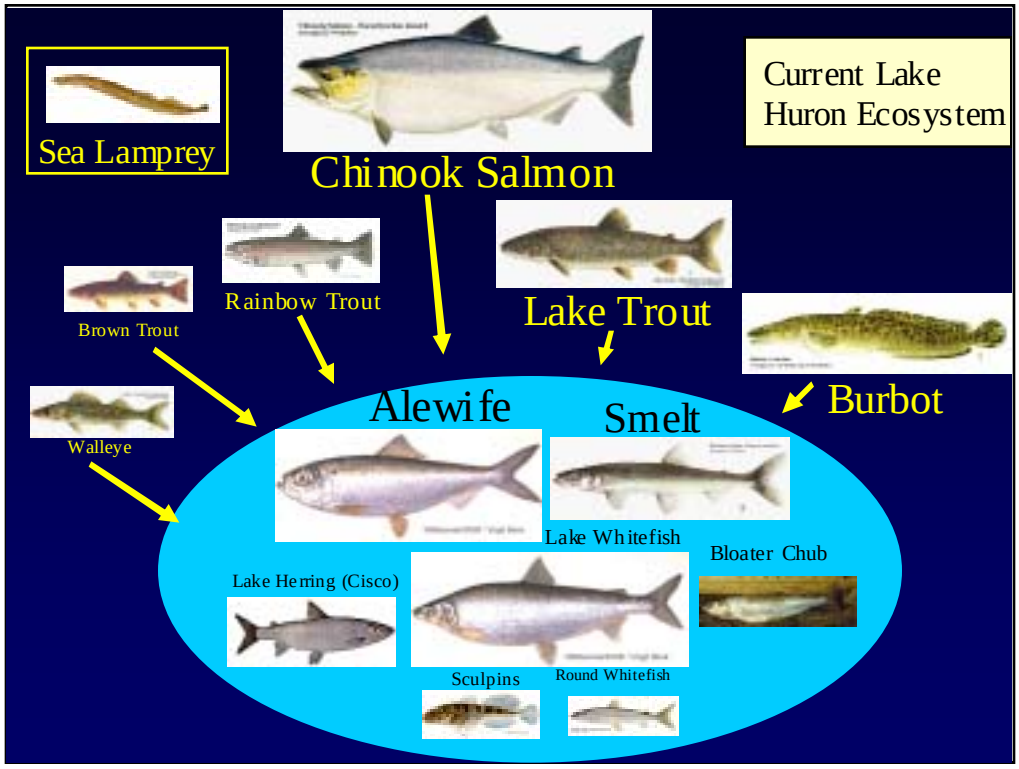
• The recovery of the recreational & commercial fisheries in the Great Lakes is a major fisheries management success story.



• The original ecosystem had lake trout as the main, or keystone predator, with walleye and burbot playing lesser roles.

• The prey base was dominated by lake herring (or cisco) and several other species of deepwater ciscos and to a lesser extent sculpins.

• Round whitefish and lake whitefish were also lesser prey items.



• Today chinook salmon are the main consumer, feeding mainly on non-native forage (alewife and smelt).

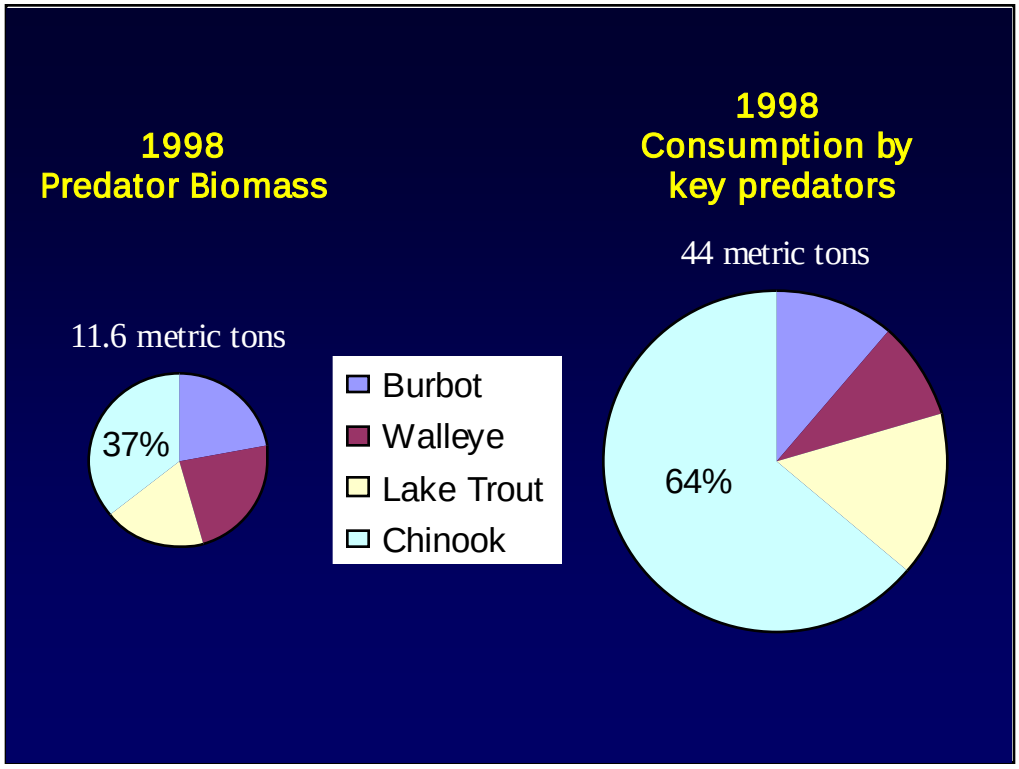
•Lake trout are still a significant factor due to stocking but their consumption rates are much lower than chinook and they have a more varied diet.

• Burbot have increased, while walleye have declined.

• Brown and rainbow trout play a smaller role as predators

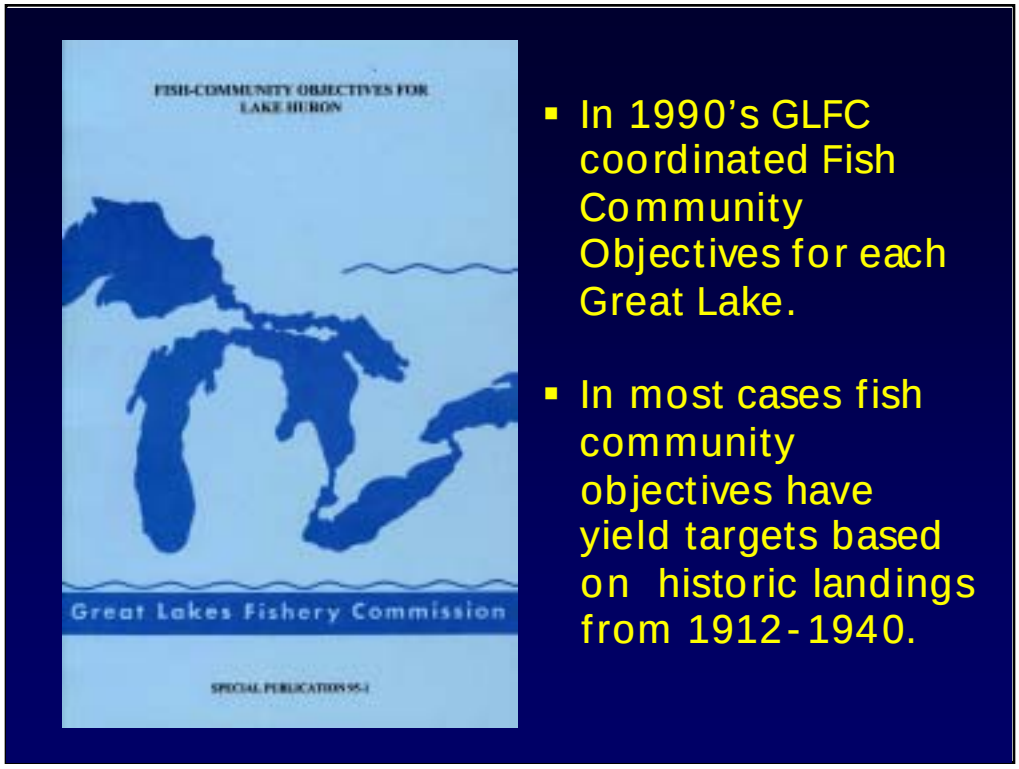
• Alewife are the main prey with smelt being second. But their abundance can fluctuate significantly between years.

• Lake herring, bloater chub & sculpins as prey are down significantly in abundance.



• To put chinook salmon consumption in context here is the estimated biomass of the four top predators in the main basin of Lake Huron in 1998.

• Chinook salmon represented 37% of the estimated biomass but represented 64% of the consumption by those four predators.



• To provide better management of the Great Lakes ecosystems, the GLFC coordinated Management Agencies to document specific desired characteristics for each lake during the 1990's.

• These Fish Community Objectives encapsulated the best current understanding of the ecosystem function.

•In most cases the fish community objectives were yield targets by species based on historic landings from 1912-1940.

• One of the emerging realizations in the current assessment of the State of Lake Huron is that historic and even current harvest levels for some species may not be sustainable.

• It is unknown if historic yields would have even been sustainable in the long-run.

•Possibly switching targeted species, size composition changes, successive fishing-up of different stocks, changes in fishing effort and fishing power may all have masked the steady decline of fish stocks over this time period. Evidence shows that once WF declined

• Comparing current harvest with historic levels is a valuable exercise but needs to be done in context.

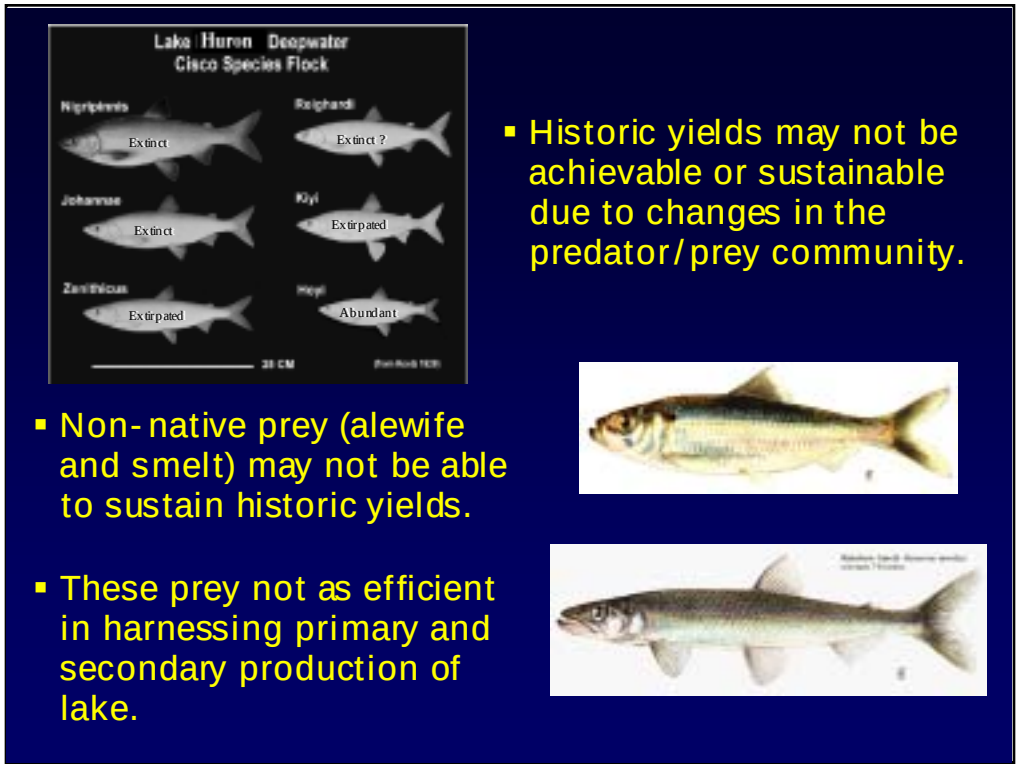
I. The Goderich fishing fleet, 1884.

- Historic yield may provide idea of what fully recovered fish community might sustain rather than a specific target.
- Need to target some form of historic fish community structure dominated by self-sustaining populations of top predators.

• Historic yield can provide an idea of what a fully recovered fish community might sustain rather than a specific target.

• One approach might be to use historic yield to provide an initial target and then use adaptive management to refine those targets.

• The main goal is to seek some community similar to the historic structure, dominated by self-sustaining populations of top predators.



• Another reason historic yields may not be achievable or sustainable is due to changes in the predator/prey community.

• Non-native prey (dominated by alewife and smelt) may not be able to sustain historic yields of top predators that were supported by a much different prey base.

• Non-native prey species are likely not as efficient in harnessing the primary and secondary production of the lake as were historic species such as the diverse species of ciscoes.

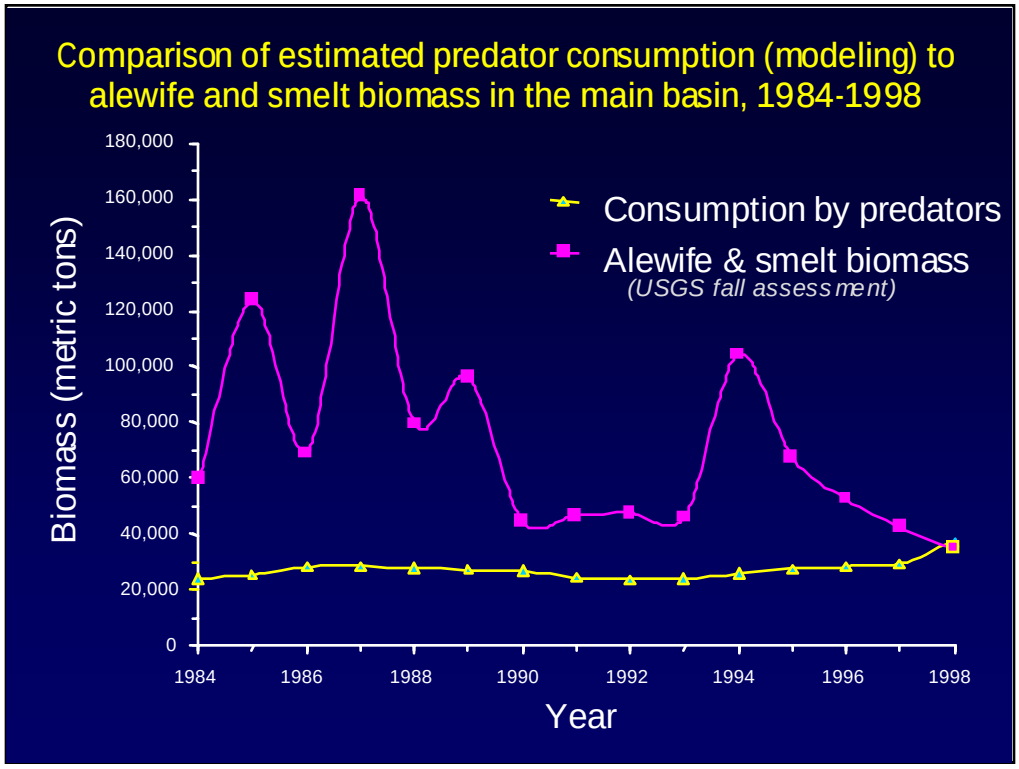
- Introduction of non-natives species may divert much of the primary and secondary production to areas not utilized by introduced salmonids.
- Native lake trout would have once utilized some portion of the benthic prey.

Zebra mussel
(*Dreissena polymorpha*)

Spiny Water Flea
(Bythotrephes cederstroemi)

• The introduction of non-native species such as zebra & quagga mussels and spiny water flea may divert much of the primary and secondary production of the lake to different pathways, making it unavailable to top predators.

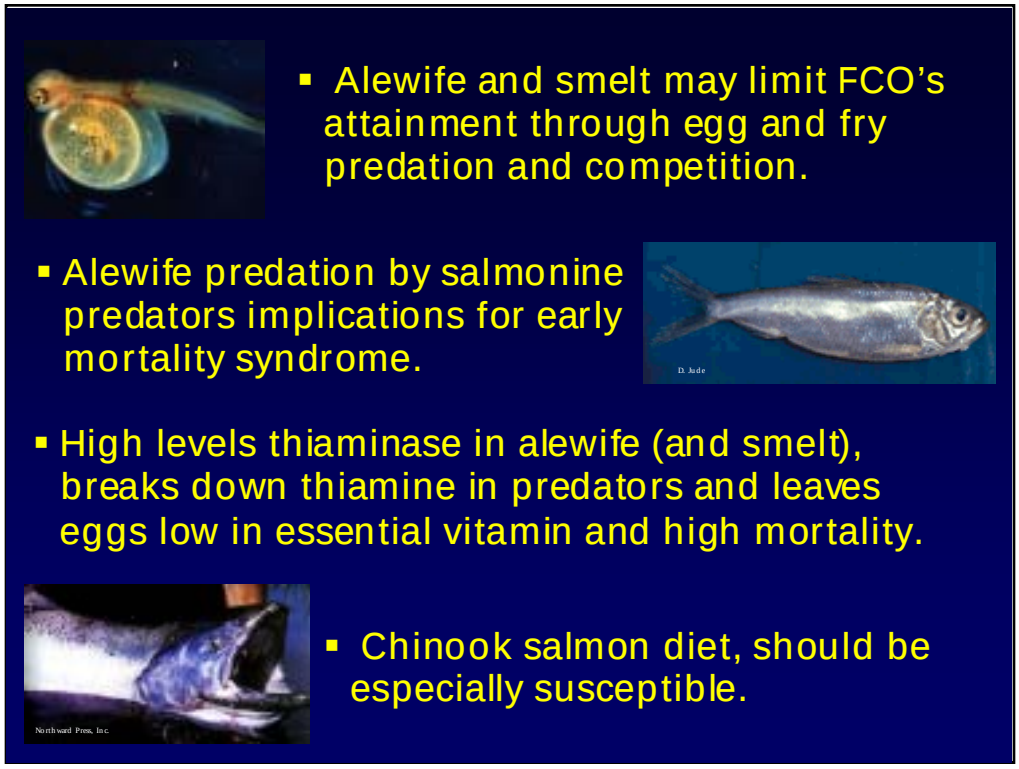
• In addition, non-native salmonids which feed almost exclusively on alewife and smelt, are likely less efficient at utilizing productivity than indigenous lake trout, in that lake trout has a much more varied diet and would have once utilized some portion of the available benthic prey in addition to forage fish.



• Recent modeling simulations of Lake Huron predator/prey interactions have indicated that current predator levels are consuming a substantial portion of the production of prey species.

• The reduced efficient use of primary and secondary productivity may explain why predator consumption appears to be approaching prey capacity despite predator abundance being much lower than historic levels.

• Therefore, for a number of possible reasons, under the current state of the lake ecosystem, it appears we cannot sustain harvest levels experienced prior to the 1940s.



• Alewife (and smelt, to a lesser extent) may also prevent attainment of FCO's for several species including lake trout through direct egg and fry predation and competition.

• In addition, alewife predation by salmonine predators could indirectly result in early mortality syndrome.

• This problem results from the high levels of the enzyme thiaminase in alewife (and to a lesser extent in smelt), which breaks down thiamine in predators and leaves their eggs low in this essential vitamin.

•This can result in very high mortality rates of the young of the predator species.

• Chinook salmon should be more susceptible than other species since their diet is almost exclusively alewife and smelt, but they seem to have better reproductive success than lake trout, so there are parts of this situation still not well understood.

- Great Lakes fisheries communities have been greatly affected by sea lamprey.
- St. Marys River largest source of sea lamprey in Great Lakes.

- Exceeding production from all other tributaries combined.
- Chemically treated in 1998/99, early results encouraging, but sea lamprey continue to impede achievement of FCO's for species such as lake trout.

• The introduction of sea lamprey into the Great Lakes was likely the biggest factor in changing the Great Lakes fish communities.

• As most of you are probably aware the St. Marys River flowing from Lake Superior to Lake Huron was the largest known single source of sea lamprey in the Great Lakes.

• Estimates were that it exceeded the numbers of sea lamprey produced from all other tributaries combined.

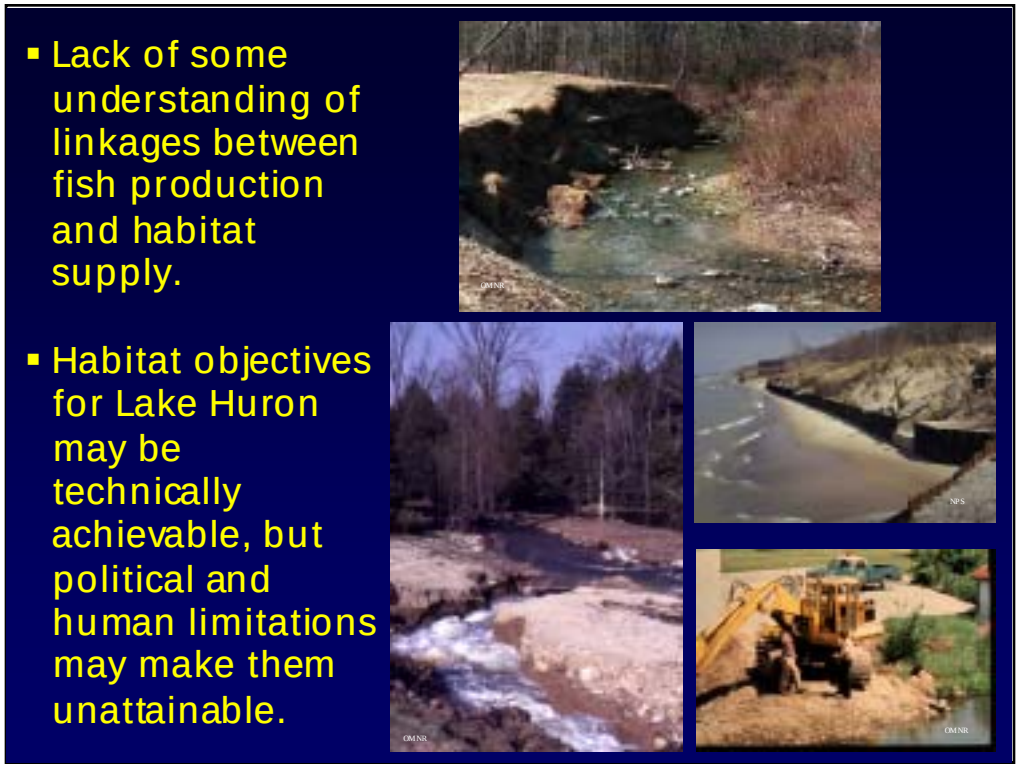
• Although the river was chemically treated in 1998 and 1999, and early results are encouraging, sea lamprey continue to impede the achievement of FCO's for species such as lake trout.

- Sea lamprey abundance above targets for 2000.
- 80% reduction by 2010 difficult to achieve without increased control on St. Marys and other tributaries.
- Appears Saginaw River contributing to sea lamprey numbers much higher than previously assumed.

• Sea lamprey abundance is above levels targeted for the year 2000, and the 80% reduction target for the year 2010 will be difficult to achieve without substantial increases in control on the St. Marys River and other tributaries.

• Recently it appears that the Saginaw River may be contributing to sea lamprey numbers much higher than previously assumed.

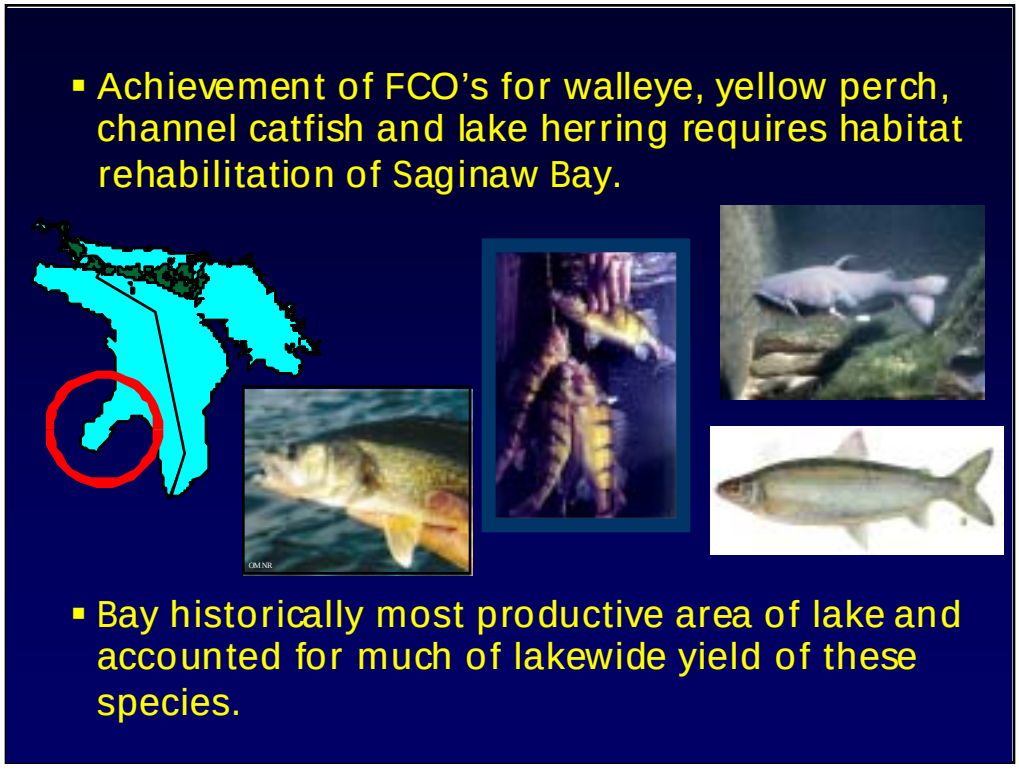
• Therefore the war on sea lamprey in Lake Huron is far from over.



• Regarding fish habitat, there is a lack of understanding of some of the linkages between fish production and habitat supply.

• Although habitat objectives for Lake Huron may be technically achievable, political and human limitations may make them unattainable.

• Currently the GLFC is funding development of Environmental Objectives for Lake Huron which will develop preliminary targets for habitat to aid in achieving FCO's.

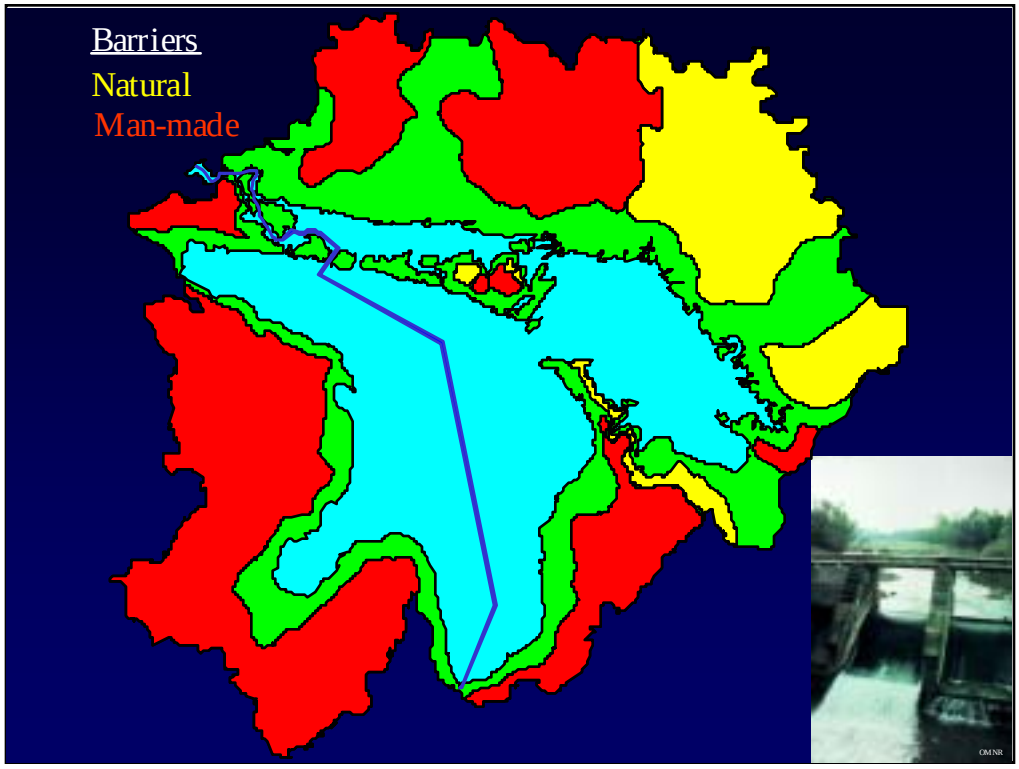


• Achievement of FCO's for walleye, yellow perch, channel catfish and lake herring cannot occur without the rehabilitation of the aquatic habitat of Saginaw Bay.

• This Bay was historically the most productive area of the lake and accounted for much of the percentage of the lakewide yield of these species of fish.

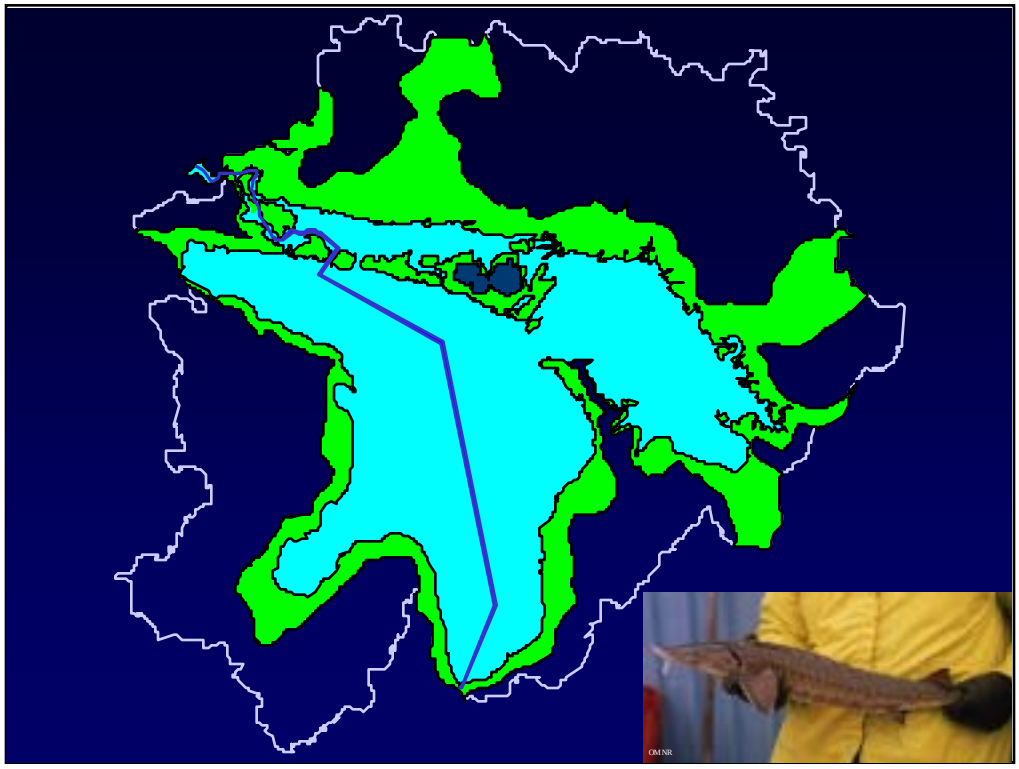
• Saginaw Bay is the most significantly deteriorated area of fish habitat in Lake Huron, despite once being the most productive area of the lake.

• MDNR is currently drafting a walleye recovery strategy for Saginaw Bay which is aimed at re-establishing this species to some level of it's former abundance.



• Tributary habitat is a concern for attainment of FCO's as discussed in Jim Bredin's talk.

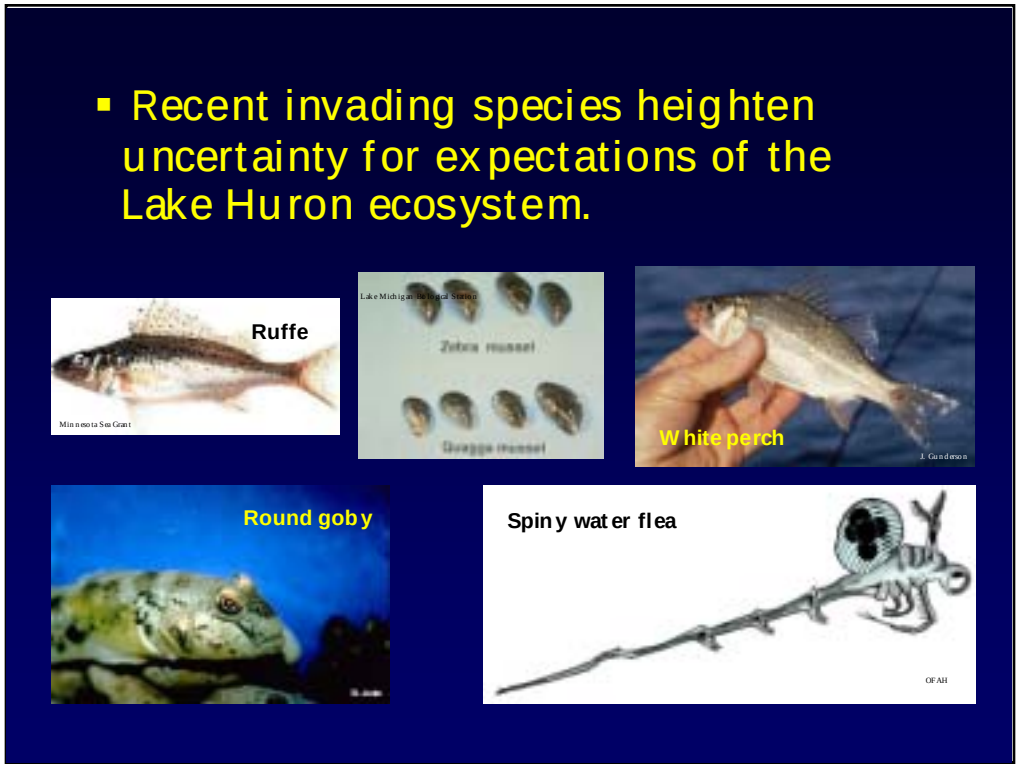
• Here we have the portions of the Lake Huron watershed first inaccessible due to natural barriers, and next from man-made barriers.



• These barriers to fish passage continue to prevent the full use of historic spawning and rearing areas for native species such as walleye, lake sturgeon and brook trout.

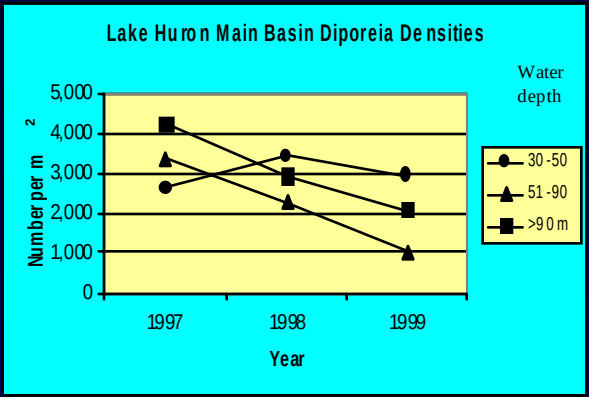
•And these barriers block passage of migratory non-native salmonids.

•Part of the Environmental Objectives exercise will be to recommend actions to provide fish more access to tributaries.



• The recent invasion of Lake Huron by zebra and quaga mussels, round gobies, the spiny water flea, white perch and ruffe heighten the uncertainty for expectations for the Lake Huron ecosystem.

- Suspicion zebra mussels contribute to reduction and elimination of *Diporeia* (important invertebrate food [amphipod] for fish including lake whitefish).



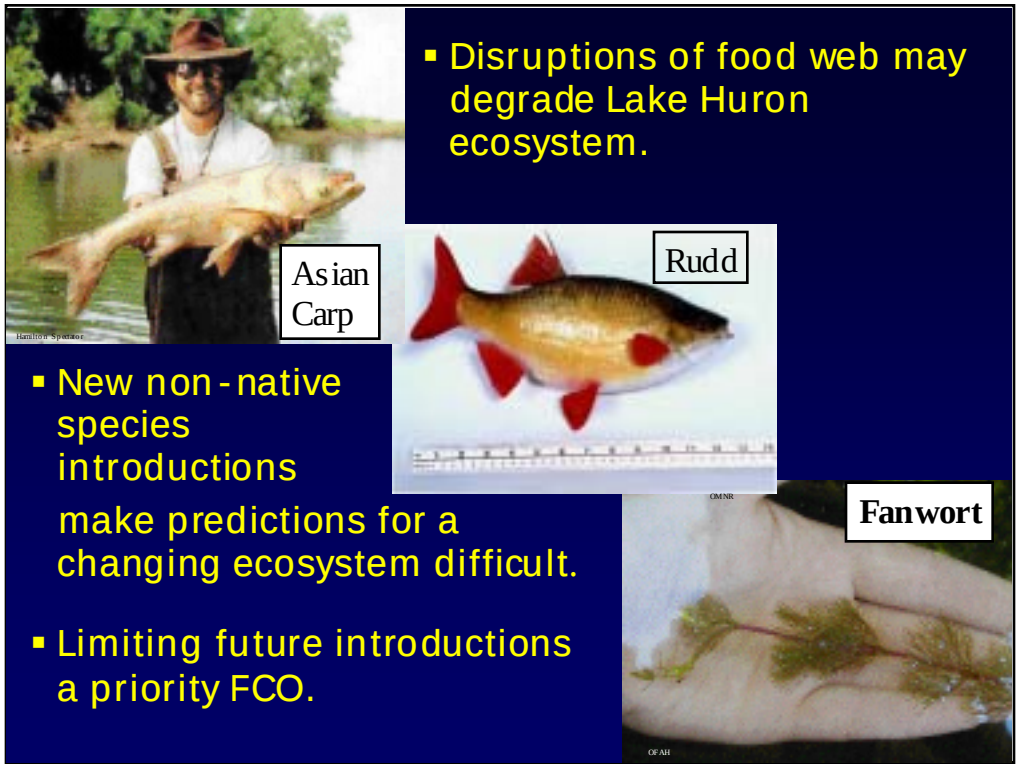
- Similar to situation occurring on Lake Michigan and western Lake Ontario.

• Recently *Diporeia hoyi*, an important invertebrate food for a number of species of fish including lake whitefish has had significant reductions in abundance, especially in southern Lake Huron.

• This is similar to the situation that is occurring on Lake Michigan and western Lake Ontario.

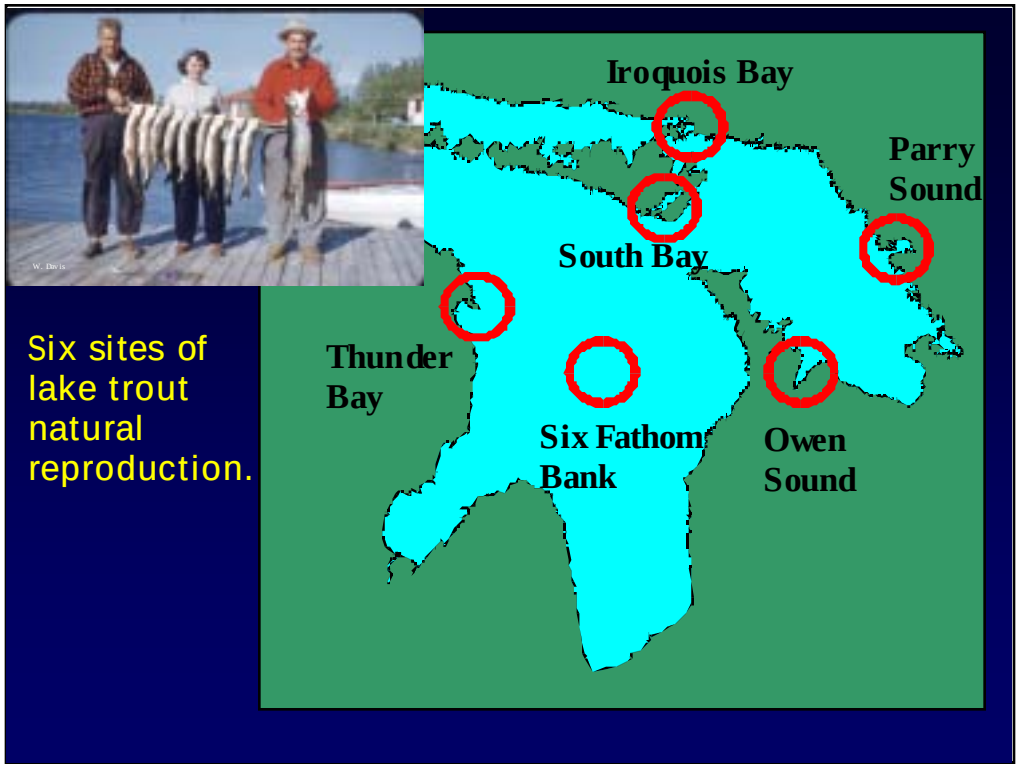
• There is a suspicion that the *Diporeia* declines may be related to the invasion of zebra mussels.

• The mechanisms for the interaction between zebra mussels and Diporeia are uncertain, but they may include direct competition for food.



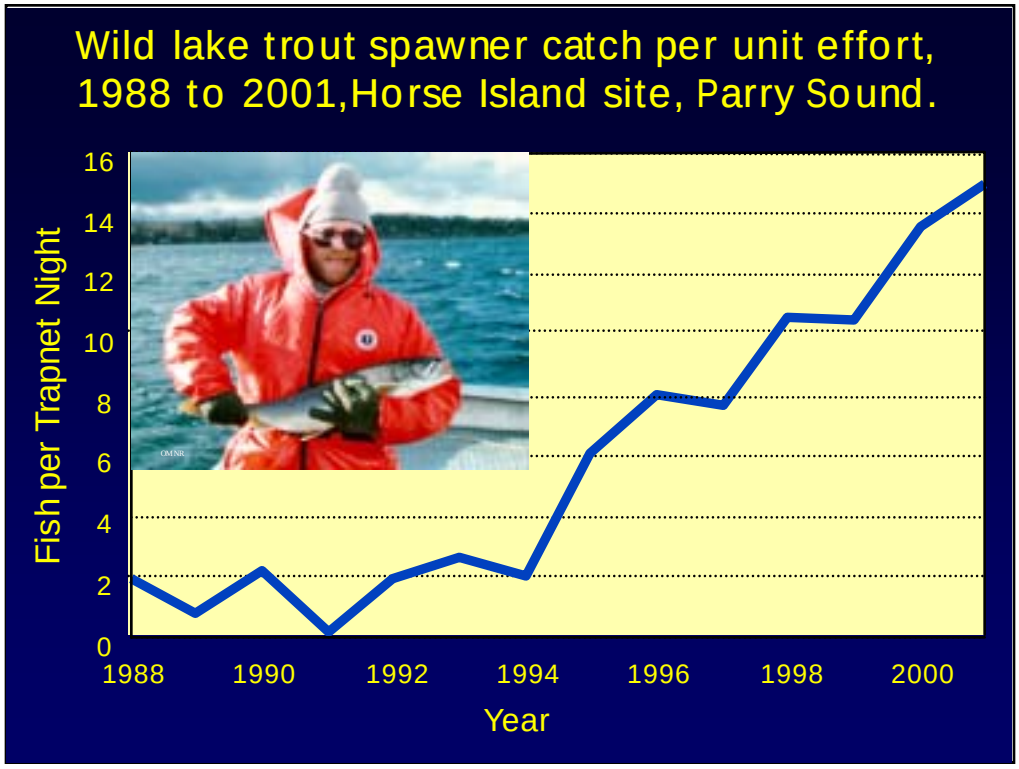
• Additional new non-native species that are likely to be introduced into the food web will have unknown effects and make it even more difficult if not impossible to define reasonable expectations for an ever changing ecosystem.

• Limiting future introductions of non-native species, therefore needs to be a priority FCO.



• I would like to stress that some achievements have been made on Lake Huron.

• Six sites of natural reproduction of lake trout have been documented on Lake Huron (including the two remnant populations).



• The Parry Sound lake trout population in Georgian Bay, which was one of the two remnant stocks in the lake, has been deemed rehabilitated.

• This is the only site in the lower four Great Lakes where lake trout rehabilitation has been successful.

What worked for Parry Sound:

- Effective sea lamprey control
- Stocking of progeny from native stocks
- Stocking at levels exceeding 4.5 yearlings/ha
- Significant exploitation control
- Cessation of stocking when sufficient natural reproduction occurs
- Protection of fish during all times of the year

• Some lessons that have been learned in Parry Sound are being recommended for use in other areas of Lake Huron and the Great Lakes.

• These include:

- •Effective sea lamprey control
- •Stocking of progeny from native stocks
- •Stocking at levels exceeding 4.5 yearlings/ha
- •Significant exploitation control (sport & commercial)
- •Cessation of stocking when sufficient natural reproduction occurs
- •Protection of fish during all times of the year

• Despite these limited successes with lake trout rehabilitation - sea lamprey in combination with commercial and sportfishing harvest continue to be major impediments to further success.

• Although other factors may impede lake trout rehabilitation, Lake Huron managers are currently attempting to address exploitation concerns to provide lake trout with the best chance of rehabilitating lake-wide.

Why Lake Trout ?

- Healthy lake trout = healthy environment (barometer)
- Broad niche - deep/shallow water, inshore/offshore
- Original native keystone predator in Lake Huron
- Best suited as dominant predator (adapted)
- Food requirements varied resulting in stable populations
- Remain in lake basins where stocked
- Potentially self-sustaining
- Can provide economic returns for commercial and sport fisheries.
- Cultural value to commercial, sport fisheries and First Nations.

• Why have we spent so much time and effort to try and rehabilitate lake trout in the Great Lakes?

• These are a few of the major reasons for this concerted international effort.

• Healthy lake trout = healthy environment (barometer) our miner's canary

• Broad niche - deep/shallow water, inshore/offshore

• Original native keystone predator in Lake Huron

• Best suited as dominant predator (adapted to Lake Huron environment)

• Food requirements are varied resulting in more stable populations between years

• Remain in lake basins where stocked - making mgmt. easier

• Potentially self-sustaining - no need to stock forever

• Can provide economic returns for commercial and sport fisheries.

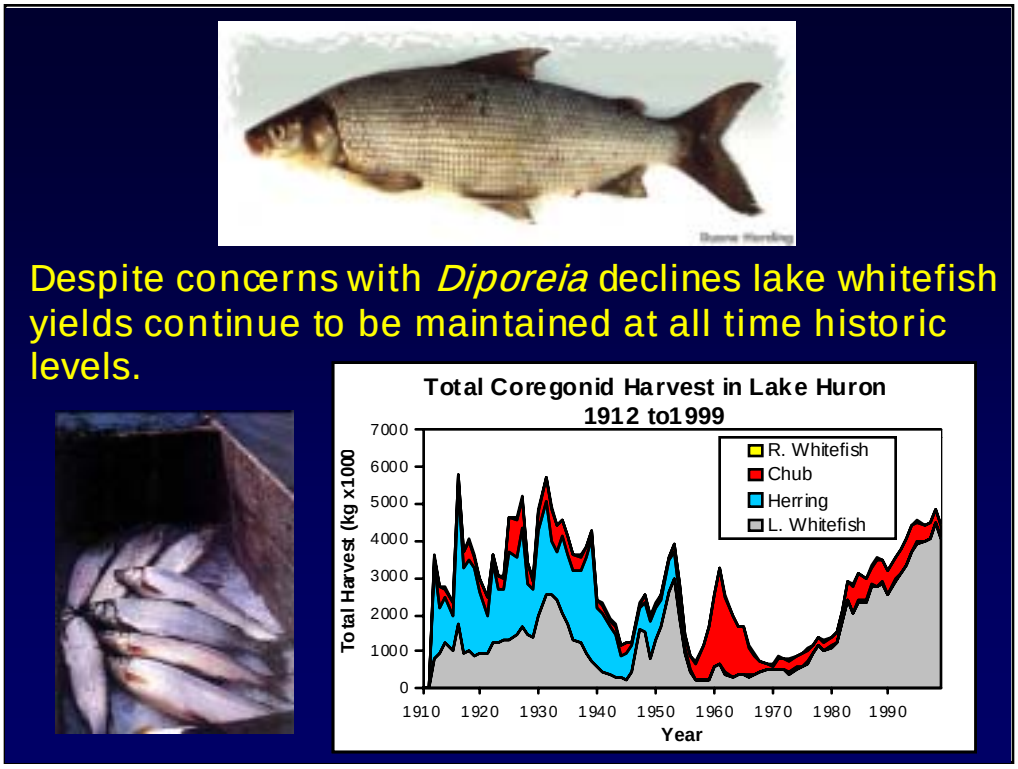
• Cultural value to commercial, sport fisheries and First Nations.

• We have already heard in Jim Bredin's presentation about the achievements with Lake Huron areas of concern.

•Keith Sherman

- Need to strive to reduce direct discharge and long-range atmospheric loading of contaminants.
- Required to remove fish species from consumption advisories and meet the contaminant objectives of the GLWQA.

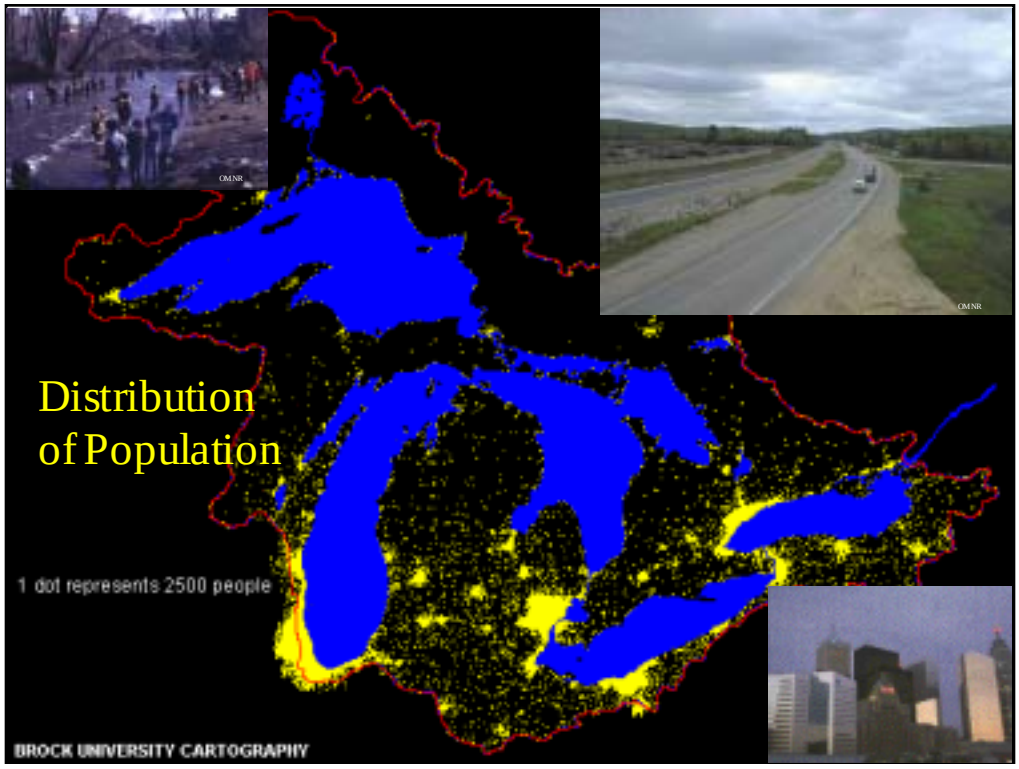
• And we have heard reductions of some contaminant levels have occurred, although additional work is needed.



• Another encouraging situation on Lake Huron is that lake whitefish yields continue to be maintained at all time historic levels.

• This has provided an exceptionally successful commercial fishery for the past 20+ years

• However, there is uncertainty about the future of whitefish since the situation could change with declines in *Diporeia*, as previously mentioned.

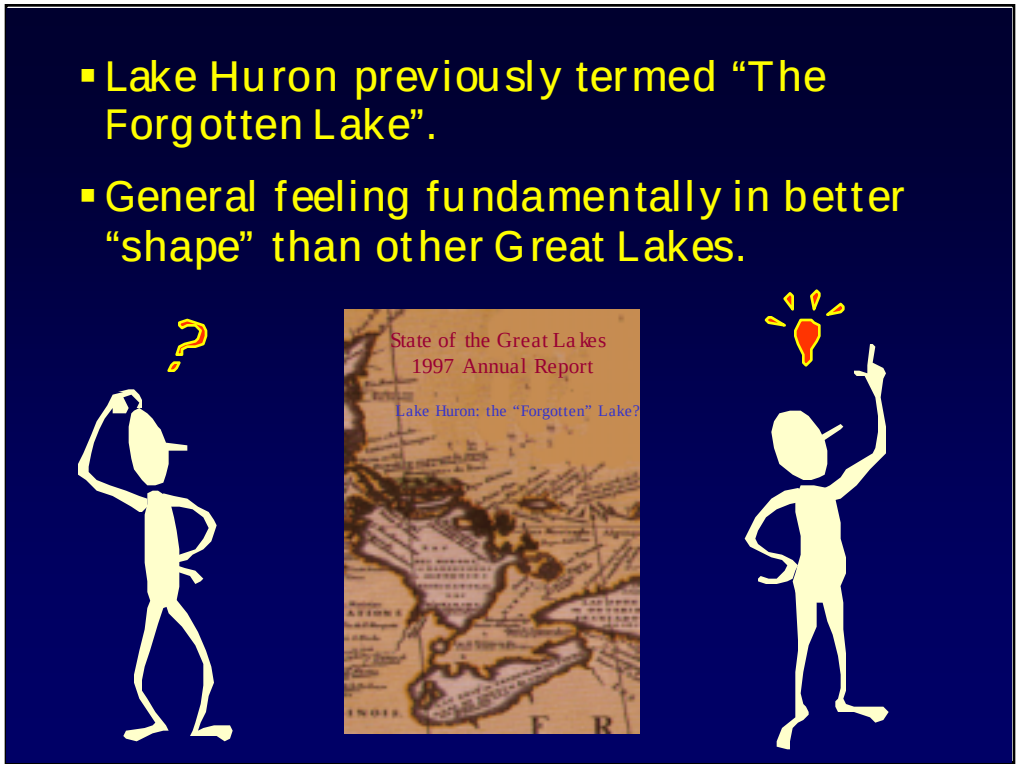


• Unlike Lakes Erie, Ontario and Michigan, - Lake Huron has not experienced the same decline in water quality parameters.

• Much of this is a result of the relatively low population density and industrialization within the watershed.

• Although the population of the watershed is relatively low compared to the other lower Great Lakes, it is within easy commuting distance of much higher population areas and it is a growing destination for millions of cottagers, tourists and anglers.

• The mounting development pressures on Lake Huron from improved highways, **and** diminishing resources in other locations, will likely increase harvest and development pressure and strain the achievement of sustainability.



• Lake Huron has previously been termed the “Forgotten Lake”.

• So deemed presumably due to the general feeling that it was fundamentally in much better “shape”, and has therefore had less attention than the other Great Lakes.

• I hope that my talk today has clarified that there is, and will continue to be, significant impediments to returning the Lake Huron ecosystem to a desired state.

• Although there are a few success stories on Lake Huron they are still relatively limited and much work still needs to be done.

• Finally the State of the Lake in 1999 document is being drafted and should be published as a GLFC report in 2003.

• Many authors from many different agencies have contributed to the GLFC State of Lake Huron report and although I don't have time to acknowledge them all individually I would like to stress this document is a collaboration of many individuals.

• If you are interested in more detailed information on Lake Huron I suggest you seek a copy of this document, through the GLFC, when it is published next year.